Chorion Surface Features of Some Spider Eggs

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Little is known about the structure and function of the chorion of spider eggs. Numerous investigators have studied developmental stages of the embryo (e.g. Vachon and Hubert, 1971); yet comments about the chorion surface are rare. Ehn (1963) has noted that the chorion surface is granulated but no description of the granules was provided. Using a Scanning Electron Microscope (SEM), we studied uncoated and coated spider eggs of two species to resolve the nature of the granulated surface.

Materials and Methods

Eggs from the black widow, *Latrodectus hesperus* Chamberlin and Ivie (collected in Phoenix, Arizona Sept. 1976), and crab spider *Tmarus angulatus* (Walckenaer) (collected in Flagstaff, Arizona March 1977), were removed from egg cases one to three days after they were laid and attached to SEM stubs with graphite emulsion. Most of the eggs were viewed without coating, although some were coated with gold prior to examination. Eggs were never fixed or dried. On several occasions, one to two weeks after they had been laid, we examined eggs that had not been previously mounted or viewed in order to note changes during development. Viability from a given egg case was confirmed by the later hatch of spiderlings. Examination through secondary electron or back scatter mode, sometimes with gamma, was done with an AMR 1000 operating at 5, 10, and 20 KV.

Spheres covering the chorion of eggs from both spiders were measured by placing a 10 x 10 line grid system over electronmicrographs and measuring all spheres within 10 grid squares, chosen at random by means of a random number table.

Results and Discussion

Spider eggs appear to be highly suitable for SEM study in the living state, without any special treatment. Charging problems were minor and usually could be avoided by using gamma or back scatter mode. Figures 1 and 3 show uncoated eggs viewed by secondary and back scatter electrons respectively. Coating with gold aids little at lower magnifications (Fig. 2) but is critical for good resolution of sphere surface pits at higher magnifications (Fig. 7). Higher magnification (Figs. 5-7) reveals the presence of small spheres as an outermost coat on the chorion. This is unlike insect egg surfaces examined thus far (Hinton, 1969). In *L. hesperus* the diameter of these spheres ranges from 0.8 to 4.5 μ ($\bar{x}=1.6$ μm, $S=0.8$, $N=174$

Table 1. Size of spheres on surface of crab spider and black widow eggs.

Crab spider, *Tmarus angulatus*, N = 152

size (μ m)	Frequency
0.40-0.79	30
0.80-1-19	59
1.20-1.59	59
1.60-1.99	20
2.00-2.39	8
2.40-2.79	2

Black widow, *Latrodectes hesperus*, N = 174

size (μ m)	Frequency
0.40-0.79	0
0.80-1.19	54
1.20-1.59	31
1.60-1.99	42
2.00-2.39	16
2.40-2.79	12
2.80-3.19	3
3.20-3.59	3
3.60-3.99	5
4.00-4.39	7

spheres). The spheres on the chorion of the crab spider range from 0.4 - 2.8 μ m ($\bar{x}$= 1.1 μ m, S = 0.45, N = 152 spheres).

There is a considerable difference in the distribution of sphere diameters (Table 1). The crab spider has a more homogenous set of sphere sizes, while the black widow has a greater proportion of larger spheres. Relatively high SEM resolution shows that many, although not all, of the larger spheres from *L. hesperus* have numerous indentations or pits on their surface (Fig. 7). The smaller ones are relatively smooth at the same high resolution. We have not seen these perforate surface features in spheres from the crab spider.

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Fig. 1. *L. hesperus* egg, 5 days after laid. Uncoated - secondary electrons. x 33. Fig. 2. *L. hesperus* egg, 5 days after laid. Gold coated - secondary electrons. x 33. Fig. 3. *L. hesperus* egg, 5 days after laid. Uncoated - back scatter electrons. x 33. Fig. 4. *T. angulatus* egg, 2 days after laid. Uncoated - back scatter. x 33. Fig. 5. *T. angulatus* chorion surface spheres. Uncoated - secondary. x 1000. Fig. 6. *L. hesperus* chorion surface spheres. Arrow is location where a sphere has detached. Coated - secondary. x 1000. Fig. 7. *L. hesperus* chorion surface spheres at higher resolution. Large sphere pitting is clear. Gold coated - secondary. x 6,900. Fig. 8. *L. hesperus* several days prior to hatching. Note chorion is cracked around the cephalothorax. Coated - secondary. x 40. Fig. 9. Higher magnification of Fig. 8 showing chorionic spheres more clearly. x 120. Fig. 10. *L. hesperus* first molt spiderling abdomen with spheres. Uncoated - secondary. x 350.
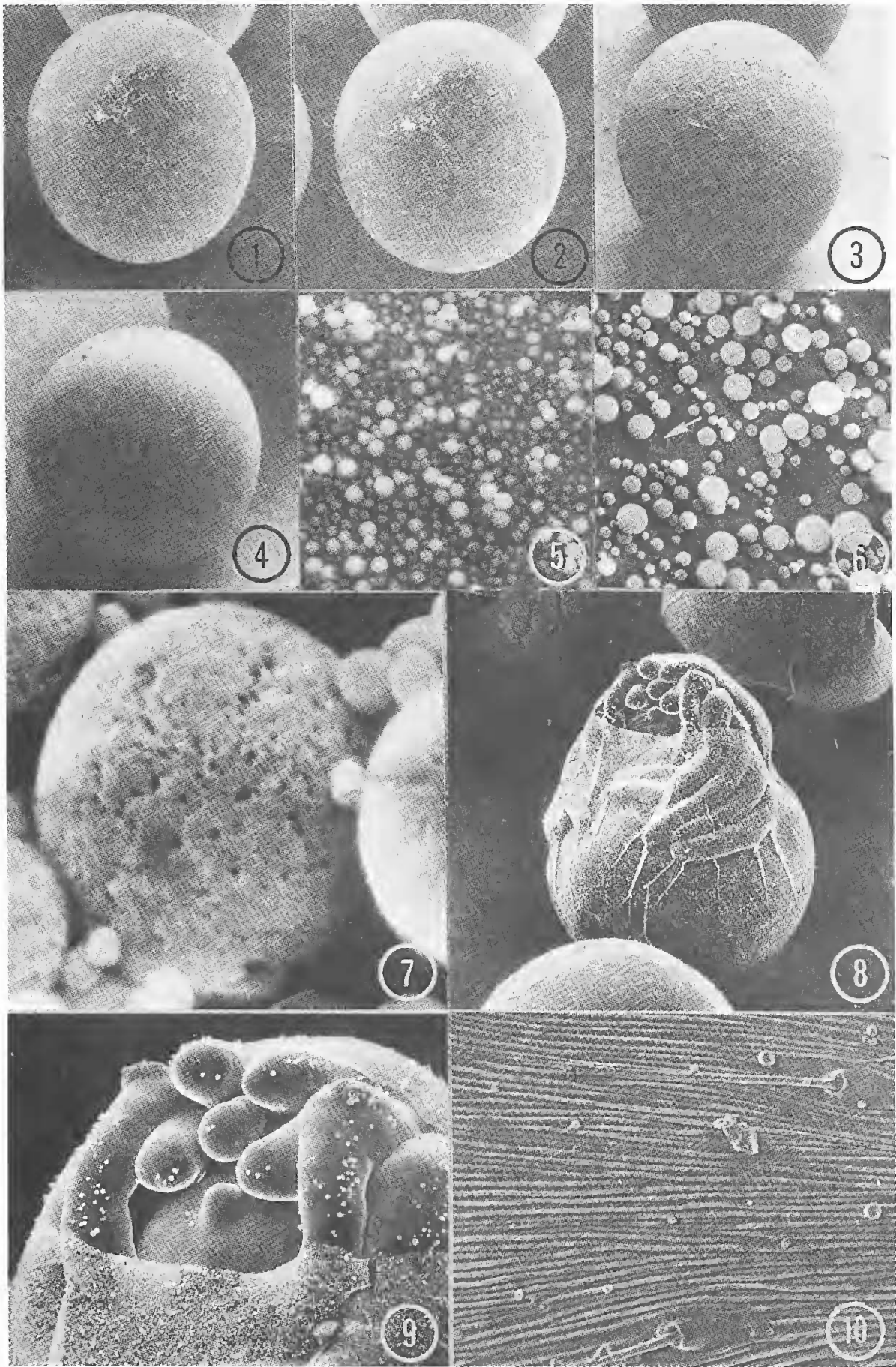
As the embryo develops, allometric growth and differentiation of the cephalothorax occur, and the egg surface begins to wrinkle (Fig. 8). Wrinkles extend away from the developing cephalothorax. The chorion cracks several days prior to hatching, leaving the mouthparts directly exposed to the environment (Fig. 9). Savory (1928) erroneously referred to this as hatching. At the same time some of the spheres break loose and can be seen adhering to mouthparts (Fig. 9). They can sometimes be seen even on the spiderling after hatching and the first molt (Fig. 10). Slight deformations appear in the laminar chorion surface where the spheres have been detached (Fig. 6).

When we opened the egg cases to remove eggs for study, the latter were left in a vial for continued incubation. Often these eggs became dessicated and the embryos did not develop beyond the cracked-chorion stage shown in Figure 8. When a drop of water was added to the vial every other day for one week, viable spiderlings hatched; thus, this operation became routine. The addition of water sometimes allowed fungus to grow, and, as a result, some eggs were destroyed. During an attempt to embed eggs for further analysis of the chorionic spheres, we discovered that the entire chorion is strongly hydrophobic.

All eggs which incubate in non-aquatic environments must be able to deal with the potential hazard of dessication. The partial coating of hydrophobic spheres on the chorions of the two spider species studied could serve to limit the surface area through which water molecules may pass to the environment. It seems reasonable that the spheres may additionally provide survival value to the egg by providing moisture repellency, thereby secondarily inhibiting fungal growth.

Literature Cited

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SCIENTIFIC NOTE

Record *Triatoma* captures from *Neotoma* dens in Southwestern United States. — Wood rat *(Neotoma)* houses or dens occasionally support large numbers of conenose bugs *(Triatoma, Paratriatoma)*. The average number of triatomes captures from 1022 wood rat houses searched in the southwestern United States from 1936 through 1973 was 3.5 per house. Capture of triatomes from 18 wood rat harborages recorded in Table 1 were all in locations isolated from human dwellings except for Griffith Park, the piles of scrap lumber at the San Joaquin Experimental Range and 8 km southwest of Fallbrook in California. The wood rat from Murray Canyon, Eaton Canyon, Fallbrook, Griffith Park and the SJER was *Neotoma fascipes*. The dens were large piles of sticks and twigs as illustrated by Linsdale & Tevis (1951, The Dusky-footed Wood Rat, U.C. Press, Fig. 56). The New Mexico triatomes were from stick houses of *N. micropus* (Wood & Wood, 1961, Am. J.